the passage of the wave-current propagating the telephonic action was exactly similar to the sinking of the heat-waves into the earth, treated by Fourier; and by reasoning from the nature of that wave propagation he concluded that the sound of a deep bass voice could be heard farther than that of a high-pitched voice. Mr. Lockwood said that experience in ocean-cable telegraphy confirmed this. Professor Carhart stated that Lord Rayleigh had from similar considerations calculated the farthest distance at which telephonic communication could be maintained in such a cable as the Atlantic cable, and gives the extreme limit as twenty miles. This is fully confirmed by experience, according to the testimony of Messrs. Preece and Lockwood.

Capt. O. E. Michaelis, of the Frankford arsenal, read a paper in which he recommended the study of the 'structural metals,' iron, copper, brass, etc., by electrical or magnetic methods, with a view to ascertaining whether some such methods could not be devised that should detect weaknesses not otherwise to be discovered.

A short discussion then took place, on the measurement of large currents, in which there was nothing particulary interesting brought out.

Professor Rowland then took up the subject of lightning protection, and gave a short development of Maxwell's suggestion that the house should be placed in a metallic cage. A house in a complete metallic cage, one enclosing it *below* as well as above, would be completely protected if the wires of the cage were sufficiently good conductors. This fact leads to the following considerations. Lightning-rods should run down the four corners of the house and across the angles of the roof, joining at the top, thus forming the skeleton of a cage. If rods are also run down the middle of the sides of the house, or if, in a long building, two or three equidistant rods are run down the sides and connected with the rods running across the roof, so much the better. These rods must be *well* grounded, otherwise they are of no use at all, and may be worse than useless; for, suppose the gas-pipes running through the house have good earth connections, the lightning will be likely to leap from the rods to the gas-pipes, and so cause destruction. The rods down the sides should therefore be connected by rods running across *under* the building, as well as by those over the roof; and the gas and water pipes, as well as all large masses of metal in the building, should be connected with the rods by good conductors. It is, of course, necessary that the rods should be of good conducting material, — solid, not hollow. As it is important that the rods should have a large cross-section, the twisted forms with large surface and very little mass of metal are not good, as there is no use in the twisting, and the most important thing is that there should be plenty of metal to conduct. There is not the slightest necessity for insulating a lightning-rod: the safety of a building depends only on its being easier for the lightning to go around it than to go through it. Of course, from the cage of rods above described, small rods bearing points are to rise at different points on the roof. How high these should be, or how close together, is not very well determined. It is considered by some, that a rod protects the space included in the cone whose height is that of the rod, and the radius of whose base is also equal to the length of the rod. Others think that a space is protected equal to the cone whose height is that of the rod, and whose base has a radius of twice that amount.

The time for adjournment having come, the conference adjourned, subject to the call of the chairman, Professor Rowland, who is also president of the commission.

It is possible that there may be another session in Philadelphia about the close of November.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF THE SECTION OF ANTHROPOLOGY.

The admirable survey of the progress of anthropological science, comprised in the address made by Dr. Tylor as president of the section, was listened to with great satisfaction by the members. In this association, as in the American, anthropology has been late in finding the recognition which its importance as a science deserves. Heretofore it has been treated as a department of the biological section. As the communications have gradually taken a wider range, and become more numerous, it was found that this subordinate status was inconvenient. At the present meeting, anthropology for the first time takes the rank of a section, and with a fortunate choice of officers, — the vice-presidents being Professors Boyd Dawkins and Dr. Daniel Wilson, and the secretaries Messrs. G. W. Bloxam (recorder), Rev. J. Campbell, Walter Hurst, and J. M. P. Lemoine.

Among the papers which attracted most attention may be ranked that of Professor Boyd Dawkins, on the range of the Eskimo in space and time. In this paper Professor Dawkins again urged with much ingenuity and force his well-known opinions as to the probability that the Eskimos are the survivors of the prehistoric race known in Europe as the 'cave-dwellers.' The Eskimos are found along the Arctic Ocean, from Labrador and Greenland to the west coast, and thence extending into Asia. Everywhere they appear to be a receding race, gradually retreating northward as they are pressed by stronger and more warlike tribes, — in America by the Indians, in Asia by the Mongols. The researches of Mr. Dall had produced evidence that they formerly dwelt on the west coast of America, far south of their present

limit. In Asia some linguistic evidence, in Professor Dawkins's opinion, showed an intercourse or intermingling between them and the Mongols, at points far to the south-west of their present abode. He did not consider that the mere fact that they spoke an agglutinative language could be regarded as evidence that they were akin to the Indians. In appearance, character, and customs, they were a distinct race; and there was a strong antipathy between them and the Indians, resulting in frequent hostilities. In fact, a wide belt of debatable land was always left between the two races. In Asia their relations with their southern neighbors were more pacific.

In dealing with the range of the Eskimos in time, we pass from the historic ground into the domain of geology. We have to go back to the 'cave-men,' as they are styled, whose traces are found not only in caves, but along the course of rivers and in other localities. They dressed in skins, and wore long gloves. They were skilled in the use of the needle, which was made of bone. They wore necklaces; they painted their faces. They manufactured skin-scrapers, harpoons, lance-heads, and other implements, of stone and bone. They were manifestly a race of hunters and fishermen, of a rather superior type. They were also artists of no mean skill, as a sketch of a reindeer and the outline of the head of an elephant (of both of which copies were exhibited) fully testified. Of human remains belonging to this race, there was unfortunately an almost entire lack. Professor Dawkins did not believe that any of the skeletons or crania usually referred to this people really belonged to them. There was every reason to think that they did not bury their dead, but left them to be devoured by the wild beasts, and especially the hyenas which then abounded in southern Europe.

This and all the other characteristics of the cave-dwellers are precisely those of the Eskimos of the present day. They are hunters and fishermen, wearing skin dresses with long gloves, are highly artistic in their tastes, and do not bury their dead. If the question is asked, how they came to emigrate to America, it must be remembered that the same question applied to the mammoth which they hunted. Remains of this animal are found in great abundance from western Europe across northern Asia, and thence throughout North America. They had, of course, passed over at a time when the two continents were united at what is now Bering Strait. When the mammoth, and the animals which were contemporary with it, migrated in this direction, the cave-men who hunted them would naturally go with them. In all probability there was a period when people of this race were scattered over a wide region of the earth extending from western Europe to northern America.

In the discussion which followed, Prof. T. Rupert Jones expressed the opinion that the skeletons found in the caves and other localities where the implements of the cave-dwellers have been discovered belonged to this race; and if so, they were a tall people, of a bodily structure very different from that of the Eskimo. Dr. Wilson remarked that the hostility between the Eskimos and the Indians adjoining them is no greater than that which often exists elsewhere between two tribes of Indians; as, for example, between the Sioux and the Chippewas, where it is always found necessary to keep a wide space of uninhabited land between them. As to the similarity of implements and usages, that is common between barbarous races whose condition and surroundings are similar. The fact that the Eskimos do not bury their dead is readily accounted for by the climate, which would usually make burial impossible. Professor Dawkins, in reply, insisted that there was no evidence that the skeletons mentioned by Professor Jones belonged to the cave-men. He believed them to be intrusive burials. As to the similarity of implements, it must be remembered that in the present case the resemblance extended far beyond a few rude stone or bone tools and weapons, and included the element of artistic faculty and products. The result of the discussion appeared to be, that the paper, while admitted to be highly valuable as a contribution to our knowledge of the subject, left the opinions on the different sides as widely apart as before.

Mr. F. W. Putnam gave a most interesting account of his examination of a group of mounds in Hamilton county, O., made on behalf of the Peabody museum at Cambridge. Discoveries were made which seem to far exceed in interest and importance any thing which has before been learned concerning the builders of these mounds. As this search will be the subject of a much more elaborate paper, which will be read before the American association, a summary of it would be out of place here. All that need be said is that the facts detailed by Mr. Putnam seem to show a more complex social life, more abundant and varied artistic products, and a higher status altogether, than can be deemed consistent with the views of those who hold that these mound-builders were merely the ancestors of our present Indians, and in the same stage of culture.

An important communication by Major Powell, on the classification of American languages, was illustrated by an ethnographic map, comprising the greater part of America north of Mexico, with some vacancies where the affinities of the tribes are considered by him to be not fully determined. The number of distinct linguistic stocks in this region is quite large; and as they have been studied by many investigators, some confusion has arisen from the variety of names given to them. Major Powell proposed to adopt a system of nomenclature based on certain definite rules. One of these rules is to adopt the name given to each stock by the author who had first written about it. He would not, however, go back for this purpose beyond the year 1836, the date of the publication of Gallatin's 'Synopsis of the Indian tribes,' which might be deemed the first scientific work on American ethnology. Another rule would be to discard all double names, that is, all designations formed by the union of two names, such as Huron-Iroquois, or Algonkin-Lenape. Finally, to distinguish the name of a linguistic stock or family from that of a language or dialect included in it, the former or 'stock' designa-

tion should always terminate in '*an*.' Thus we should have Eskimoan, Shoshoneean, Algonkian, Iroquoian, Pawneean, and the like, as the names of the different stocks. He was decidedly of the opinion that no mode of classifying the Indian tribes other than by their languages would be found satisfactory. The physical differences are certainly not sufficient. The arts are no criterion, as they are readily adopted by one race from another. Institutions are more permanent; but still in some cases they are adopted, and they do not sufficiently distinguish the races. Mythologies are more distinctive; and, indeed, it will generally be found that tribes speaking languages of one stock have similar mythological beliefs. There are in North America about eighty linguistic stocks, and as many mythologies. The investigation and classification of these stocks and of the languages included in them is an important part of the work which is now engaging the attention of the U. S. ethnological bureau.

In the discussion which followed Major Powell's communication, it was suggested that the establishment of a complete ethnological nomenclature was properly the work of an international commission, such as had been found necessary in geology and in electrical science. It would be a very suitable work for a committee of the anthropological section in the International association for the advancement of science which seems likely to be formed. Professor Max Müller, it was mentioned, had proposed for subfamilies or groups the termination in *ic*, as Indic, Persic, Tataric, Ugric. These and other suggestions could be considered by an international committee, whose conclusions would probably be generally adopted, and thus the confusion and uncertainty of names which now cause much perplexity would be removed. This suggestion was received by the section with indications of general approval.

Mr. C. A. Hirschfelder's paper on anthropological discoveries in Canada gave much very interesting information. His investigations have been quite extensive, including the opening of over three hundred Indian graves and mounds. The large number of Indian wares and relics found in these excavations now form an important part of the collections of the Canadian ethnological museum at Ottawa. A description of the vast Huron ossuaries, or bone-pits, was given, fully corroborating the accounts of the Jesuit missionaries. The earthworks of Canada are much more numerous and important than has been generally supposed. Most of these are considered by Mr. Hirschfelder to be the work of the Hurons and other tribes known to us; but one, of evidently very ancient date and peculiar character, he is inclined to ascribe to the mound-builders of the Ohio valley, or a race akin to them, as it bears a strong resemblance to the works constructed by that people. It is situated on an elevated ridge in the county of Elgin, a short distance north of Lake Erie, and has much the appearance of having been a stronghold in a hostile country. It comprises about eight acres, the dimensions being four hundred and twenty-eight by three hundred and twenty-five feet. A double wall, separated by a ditch twenty feet wide and five feet deep, forms the defence. The outer wall is thirty feet thick, and has on the inside a ledge where a row of men could lie at full length concealed from observation. All the arrangements show that the fortress was intended to have a strong garrison, and to be prepared to meet a large assailing force. The numerous burials and weapons in the vicinity seem evidences of a protracted warfare carried on around it. The antiquity of this singular fort is shown by the size of the trees. The largest of these is over eleven feet in circumference, and must have been nearly four hundred years old. Various indications seem to show that the defenders were finally conquered by overwhelming numbers. A natural conjecture would be, that the mound-builders had planted this outlying fortress in a conquered territory north of Lake Huron, whence they were finally expelled by the native tribes. Mr. Hirschfelder's paper contained much other information of great interest.

A very valuable paper on the Huron-Iroquois as a typical race of American aborigines was read by Dr. Daniel Wilson, evincing the wide research and careful induction characteristic of the writer. The number and extent of the Huron-Iroquois nations were described, with the characteristics which distinguished them from other Indian tribes. The people whom Cartier found at Quebec and Montreal were evidently of this race, and the evidence tended to show that they were of the Huron division of the race. The crania of the Huron-Iroquois people, like those of the northern Indians generally, were long and well developed. The contrast between their skulls and the nearly globular crania of the Ohio mound-builders was striking. The latter people were evidently very numerous and well-organized, though they had not attained an advanced degree of civilization. After examining all the evidence on the subject, the conclusion to which he had been brought was, that the mound-builders were a people of a not very high type, who were under the control of rulers of superior energy, a sort of Brahminical class, by whose direction their remarkable engineering works were constructed.

In a subsequent paper Dr. Wilson described a skull from the loess of Podbaba, near Prague; and one found in alluvium at Kankakee, Ill., along with the tooth of a mastodon. He compared the former with the famous Neanderthal skull, termed pithicoid by Huxley, and showed that there was in certain points a striking resemblance, and yet there was no evidence in the former of deficiency of brain, and probably would not be in the latter if we had the whole of it. The Kankakee skull, though found under circumstances which seem to indicate for it as great antiquity as that of the Neanderthal and Podbaba crania, is a well-formed Indian skull of the usual type. There is, however, no clear evidence that its contiguity to the mastodon's tooth was not the result of accident. It can only be said that they were found near together, and that the discoloration is about the same in both. Dr. Wilson is, however, inclined to believe that the mastodon existed to a later time on this than on the

eastern continent, and not improbably man will be found to be contemporaneous with it.

Major Powell gave an account of the peculiar marriage laws of the American aborigines, prefaced by some general considerations on the motives which had led to the establishment of these laws. These he traced mainly to the desire of preserving peace, which was a marked characteristic of the domestic legislation of the Indians. This was illustrated in their burial customs, in disposing of the effects of the deceased, and in other usages. As one of the main causes of dispute among barbarous tribes is for the possession of women, it was natural that their laws should be specially strict on this point. The manner in which marriages are regulated for this object, and especially the influence of the clan system, were clearly pointed out. As the paper is understood to be a summary of the contents of a large work, which will shortly be published in full, further details need not be added here. The clear and judicious views propounded were highly commended by Dr. Tylor.

An entertaining paper, on the customs and languages of the Iroquois, was read by Mrs. E. A. Smith. The peculiarly descriptive force of the names given by the Iroquois to the animals and other common objects surrounding them was shown by many curious examples. The word for rattlesnake means 'he squirms;' for rabbit, 'two little ears together;' for goose, 'it breaks its voice.' Tears are 'eye-juice;' sugar is 'tree-juice.' This is a mode of word-formation common in other Indian languages. Mrs. Smith affirmed that the missionaries and all other authorities who have heretofore written on the Iroquois languages were mistaken in their views as to the genders and pronouns of these languages, — a hazardous assertion. The conclusions of educated French and English missionaries, who have spent many years among the Indians, and speak their language fluently, can be properly controverted only by one who has given the same amount of time and attention to the study.

An elaborate and extremely interesting paper by Mr. F. H. Cushing, on the development of industrial and ornamental art among the Zuñis of New Mexico, illustrated by many pictorial designs, attracted much attention. It is impossible in the limited space at command to give even a summary of the contents of this valuable communication. An outline of the reasoning is all that can be attempted. Mr. Cushing finds reason to believe that the civilization of the Zuñis is purely indigenous. When they first entered on their existence in the little oases of the desert which they made their home, they were in a very low stage of barbarism; out of which they gradually raised themselves by a slow but steady course of self-development. The stages of this progress were set forth with much ingenuity and clearness. Their residences rose gradually, from the brush-covered wigwam to the small building of lava-stone, either isolated near a spring, or fastened for security to the shelf of a cliff; and thence to the huge, many-storied stone barrack, which is both cliff and dwelling in one. In like manner their earliest vessels of gourds, when incased in wicker-work for the convenience of transportation, gave the first idea of a basket or wicker tray. The basket was lined with clay to retain the food which was boiled in it; and from this custom, the knowledge of pottery took its rise. The first ornamentation of their pottery was derived from the imitation of wicker-work. Afterwards other elements of a pictorial nature came in. The gradual progress of these improvements was traced by Mr. Cushing with a care and minuteness which leave no doubt of the correctness of his theory. We thus learn the interesting truth, that civilization and art, of no mean type, may spring up among a rude people, without external impulse, in a few centuries; for Zuñi culture and art are evidently not many centuries old. The notions which some anthropologists have entertained, that many thousands of years are needed before a savage people can emerge into civilization, — which the Zuñis are just touching, — are dispelled by Mr. Cushing's discoveries. In tracing the course of this progress, good use is made of linguistics, by resorting to the original meaning of the names given by the natives to the various objects under consideration. The name of the object is found, in many cases, to give the clew to its origin.

A remarkable paper on the races of the Jews was received from Dr. A. Neubauer, now residing in England, who was described by the president as one of the most distinguished rabbinical scholars of Europe. Dr. Neubauer's essay aimed to controvert the common idea that the Jews differ from most other nations or races in the special characteristic of their purity from foreign intermixture. So far is this from being the case, that, as was shown by much evidence drawn from the Scriptures and other historical sources, the Jews have always been inclined to foreign marriages. Moreover, the number of proselytes to Judaism from the surrounding races has been very great. Few races, in fact, have undergone more intermixture with other stocks. The physical and moral differences between the communities of Jews in various parts of the world are very great indeed; and these are accounted for partly by their intermarriage with other races, and partly by the influences of their environment. To come to a thoroughly scientific conclusion as to the Jewish physique, about which many erroneous ideas are entertained, careful admeasurements are necessary. Dr. Neubauer suggested that when such admeasurements are made, the right point to begin at would be Jerusalem. The paper made a strong impression, and the president expressed his full concurrence in Dr. Neubauer's views.

An account of the habits and customs of the Innuits or Eskimos of the western shore of North America and of Point Barrow, the extreme north-west portion of the continent, was read by Lieut. P. H. Ray, and contained many facts and conclusions of much interest. He gave his reasons for believing that the Eskimos had occupied the far north of America from a remote period. Among other facts, he mentioned that snow-goggles, such as are used at present, had been dug up twenty-eight feet below the surface of

the ground. The Eskimos are, in his opinion, a people of the ice, and from time immemorial had lived along the ice-border, advancing and retreating with it, but never residing far from it. All their habits of life were formed from this contiguity. He considered them to be a race distinct from the Indians, not merely in language, but also in physical traits and in character. They had brown hair and eyes: a black-eyed Eskimo was hardly ever seen. Their complexion was a clear brown, through which the play of color could be plainly observed. They were naturally a peaceful people, and he had never known a quarrel among them. Though very superstitious, they could not be properly said to have any religion. They had no conception of a future existence. They did not bury their dead, because the climate made this usually impossible. They merely conveyed the corpse to a distance from the village, and left it to be devoured by the dogs. That, they said, was the end of the man. Still they had ideas about a superior being who had created man and other animals; and they also believed in an evil spirit, who was to be propitiated, or rather menaced, into compliance with their desires.

A paper on the nature and origin of wampum, by Mr. H. Hale, described this article as shell-money, differing from the East Indian cowries as coined money differs from bullion. It consists of circular disks or cylinders, made from various kinds of sea-shells, polished to smoothness, and strung upon strings. These served as currency among the North-American Indians, and for a time among the colonists. Strings and belts of wampum were also much employed in the ceremonial usages of the Indians, and as mnemonic records. The use of this money was traced across the continent to California; thence to the Micronesian groups in the North Pacific, where it is universal; and thence to China, where in early times, according to the native authorities, the money was made of tortoise-shell disks or slips strung on strings. The modern Chinese copper money, known to Europeans as 'cash,' is made in imitation of this tortoise-shell currency, and is strung in like manner. It is also much used in ceremonial observances, like the American wampum. The mode in which the use of this form of money may have spread from Eastern Asia to America is shown by the fact that several Japanese junks have been wrecked on the west coast of this continent during the present century, and their crews have been rescued by the Indians. The Micronesians have also large sailing-vessels, in which they frequently make long voyages, and are often driven by storms to great distances out of their course. From one or other of these sources the Californian Indians may have easily learned such a simple art as that of making and using shell beads for money; and this art was one likely to spread to the other tribes among whom it was found.

In the long and interesting discussion which ensued, the views proposed in the paper were generally approved. Professor Boyd Dawkins suggested for consideration the question whether all money might not have originated in the exchange of ornament. A doubt having been expressed, whether the shell-money was among the Indians a real currency, that is, 'a measure of value,' several facts and authorities were cited on that point. Mr. Cushing stated that it was a currency among the Zuñis, and had a definite value. Dr. Tylor mentioned the decisive fact, that among the Melanesians, who nearly adjoin the people of Micronesia, the shell-money is in use, and is employed in true banker fashion. A native who lends nine strings of this money expects to receive back ten strings from the borrower at the end of a month. To gain this interest, it must be used in common as a medium of exchange, which it could not be if it were not a measure of value.

Some other valuable papers were read; and this, the first session of section H, must be deemed to have been a particularly satisfactory one.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF THE SECTION OF CHEMISTRY.

Dr. Springer of Cincinnati exhibited and described some improvements in torsion scales and balances. These instruments are constructed with steel bands or wires, upon the twisting or torsion of which they depend for their action. Professor Caldwell inquired whether balances for chemists were made upon this principle, and their cost compared with ordinary knife-edge balances. Dr. Springer said that the very first one made was sent to Prof. F. W. Clarke at Cincinnati, and used by him for chemical analysis. Professor Clarke said that its use by him was very satisfactory. The adjustments were not easily disturbed, which was a very important matter; and it was as sensitive as a good knife-edge balance.

A paper on the chemistry of roller-milling was read by Mr. Clifford Richardson. The author stated that with ordinary milling the north-western hard winter wheat gave a dark-colored flour. This difficulty is entirely overcome by using steel or porcelain rolls run at different speeds. The results of a large number of analyses of the products of roller-milling were presented in a series of tables. The ash, oil, fibre, and albuminoids increase towards the outside of the grain. In true bran there is no gluten, the gluten cells being scattered through the interior of the grain. All the experiments were made on hard Minnesota spring wheat. Eastern wheat does not work well with roller-milling, the flour being dark-colored.

Dr. A. A. Julien read the report of progress by the committee on indexes of the literature of chemical